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(12) **United States Patent**
Goodman

(10) Patent No.: **US 6,542,585 B2**
(45) Date of Patent: ***Apr. 1, 2003**

(54) **DISTRIBUTED SPLITTER FOR DATA TRANSMISSION OVER TWISTED WIRE PAIRS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **10/125,266**

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US 2002/0110229 A1 Aug. 15, 2002

Related U.S. Application Data

(63) Continuation of application No. 09/874,733, filed on Jun. 5, 2001, which is a continuation of application No. 09/362,180, filed on Jul. 27, 1999, now Pat. No. 6,243,446, which is a continuation of application No. 09/191,168, filed on Nov. 13, 1998, now Pat. No. 6,185,284, which is a continuation of application No. 08/814,837, filed on Mar. 11, 1997, now Pat. No. 5,844,596, which is a continuation of application No. 08/673,577, filed on Jul. 1, 1996, now abandoned, which is a continuation of application No. 08/372,561, filed on Jan. 13, 1995, now abandoned, which is a continuation of application No. 08/245,759, filed on May 18, 1994, now abandoned, which is a continuation of application No. 08/115,930, filed on Aug. 31, 1993, now abandoned, which is a continuation of application No. 07/802,738, filed on Dec. 5, 1991, now abandoned, which is a continuation-in-part of application No. 07/688,864, filed on Apr. 19, 1991, now abandoned, which is a continuation of application No. 07/379,751, filed on Jul. 14, 1989, now Pat. No. 5,010,399.

(51) Int. Cl.⁷ **H04M 11/00**

(52) U.S. Cl. **379/93.01; 379/90.01**

(58) Field of Search **379/90.01, 102.01-102.03, 379/93.17, 93.26, 93.28, 93.37, 93.01; 348/14.01, 14.08-14.13, 734**

(56) **References Cited**
U.S. PATENT DOCUMENTS

3,723,653 A 3/1973 Tatsuzawa
3,937,889 A 2/1976 Bell

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

EP 062442 10/1982

(List continued on next page.)

OTHER PUBLICATIONS

*Waring, David L., The Asymmetrical Digital Subscriber Line (ADSL): A New Transport Technology for Delivery Wideband Capabilities to the Residence, IEEE Globecom 1991.

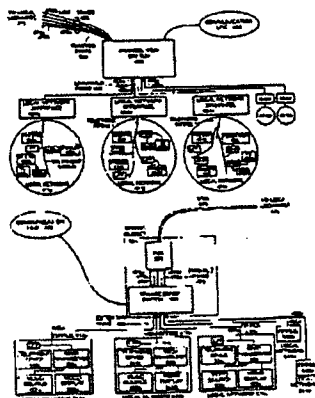
Primary Examiner—Wing Fu Chan

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(57) **ABSTRACT**

A system that provides video signal communication between a source of the video signal and a plurality of units that include destinations of the video signal includes an interface coupled to the source and to telephone lines, each of which serves at least one of the units and carries voice signals to and from one or more telephones coupled to the telephone line at said unit. The interface receives the video signal from the source, and transmits the received video signal onto at least one of the telephone lines in a selected frequency range that is different from frequencies at which the voice signals are carried on that telephone line. This causes the video signal to be coupled to a receiver which is connected to the telephone line at the unit served by that line and is adapted to recover the video signal from the telephone line and apply it to one or more of the destinations at the unit. The source is a cable (e.g., electrical or fibre optic) that is linked to the interface and that carries a plurality of video signals. The destinations are, e.g., televisions. The units can be residences (such as individual houses or apartments in an apartment building) or offices in an office building.

9 Claims, 25 Drawing Sheets



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U.S. PATENT DOCUMENTS

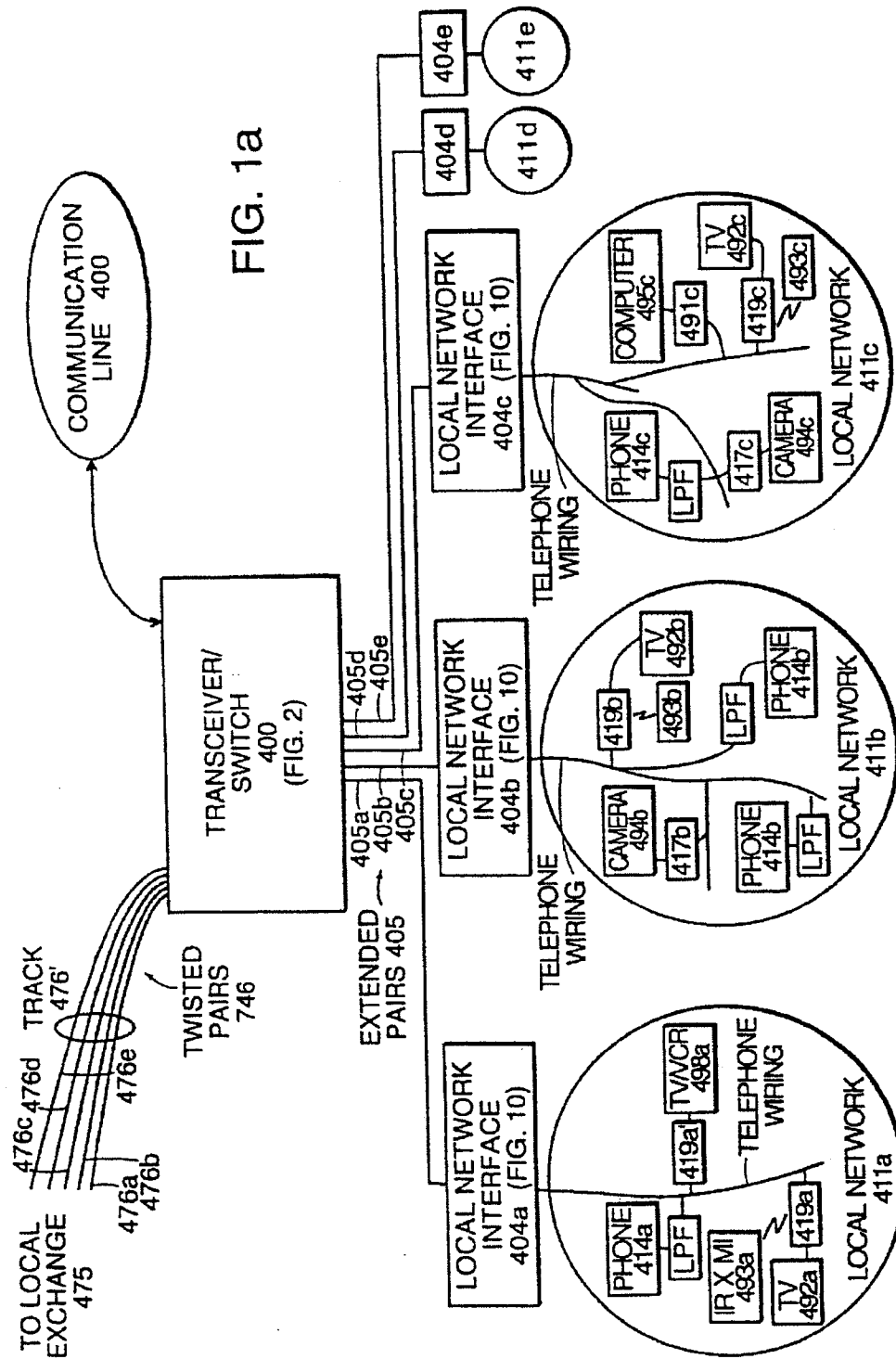
3,974,337 A	8/1976	Tatsuzawa	4,918,688 A	4/1990	Krause
3,992,589 A	11/1976	Kuegler	4,924,492 A	5/1990	Gitlin
4,054,910 A	10/1977	Chou	4,949,187 A	8/1990	Goben
4,302,629 A	11/1981	Foulkes	4,953,160 A	8/1990	Gupta
4,328,579 A	5/1982	Hashimoto	4,955,048 A	9/1990	Iwamura
4,509,211 A	4/1985	Robbins	4,985,892 A	1/1991	Camarata
4,546,212 A	10/1985	Crowder	5,010,399 A	4/1991	Goodman
4,608,686 A	8/1986	Barsellotti	5,025,443 A	6/1991	Gupta
4,670,870 A	6/1987	Sato	5,036,513 A	7/1991	Greenblatt
4,679,227 A	7/1987	Hughes	5,089,886 A	2/1992	Grandmougin
4,709,412 A	11/1987	Seymour	5,095,497 A	3/1992	Aman
4,757,495 A	7/1988	Decker	5,247,347 A	9/1993	Litteral
4,757,497 A	7/1988	Beierle	5,283,637 A	2/1994	Goolcharan
4,766,402 A	8/1988	Crane	5,844,596 A	12/1998	Goodman
4,776,006 A	10/1988	Comerford	5,929,896 A	7/1999	Goodman
4,785,448 A	11/1988	Riechart	5,949,476 A	9/1999	Goodman
4,785,472 A	11/1988	Shapiro	6,185,284 B1 *	2/2001	Goodman 379/93.01
4,799,213 A	1/1989	Fitzgerald	6,243,446 B1 *	6/2001	Goodman 379/93.01
4,807,225 A	2/1989	Flich			
4,825,435 A	4/1989	Amundsen			
4,829,570 A	5/1989	Schotz			
4,849,811 A	7/1989	Kleinerman			
4,882,747 A	11/1989	Williams			
4,885,803 A	12/1989	Hermann			
4,890,316 A	12/1989	Walsb			
4,893,326 A	1/1990	Duran			

FOREIGN PATENT DOCUMENTS

GB	2166322	4/1986
GB	2166328	4/1986
JP	127358	1/1989
WO	WO8805979	8/1988
WO	WO9107018	5/1991

* cited by examiner

FIG. 1a

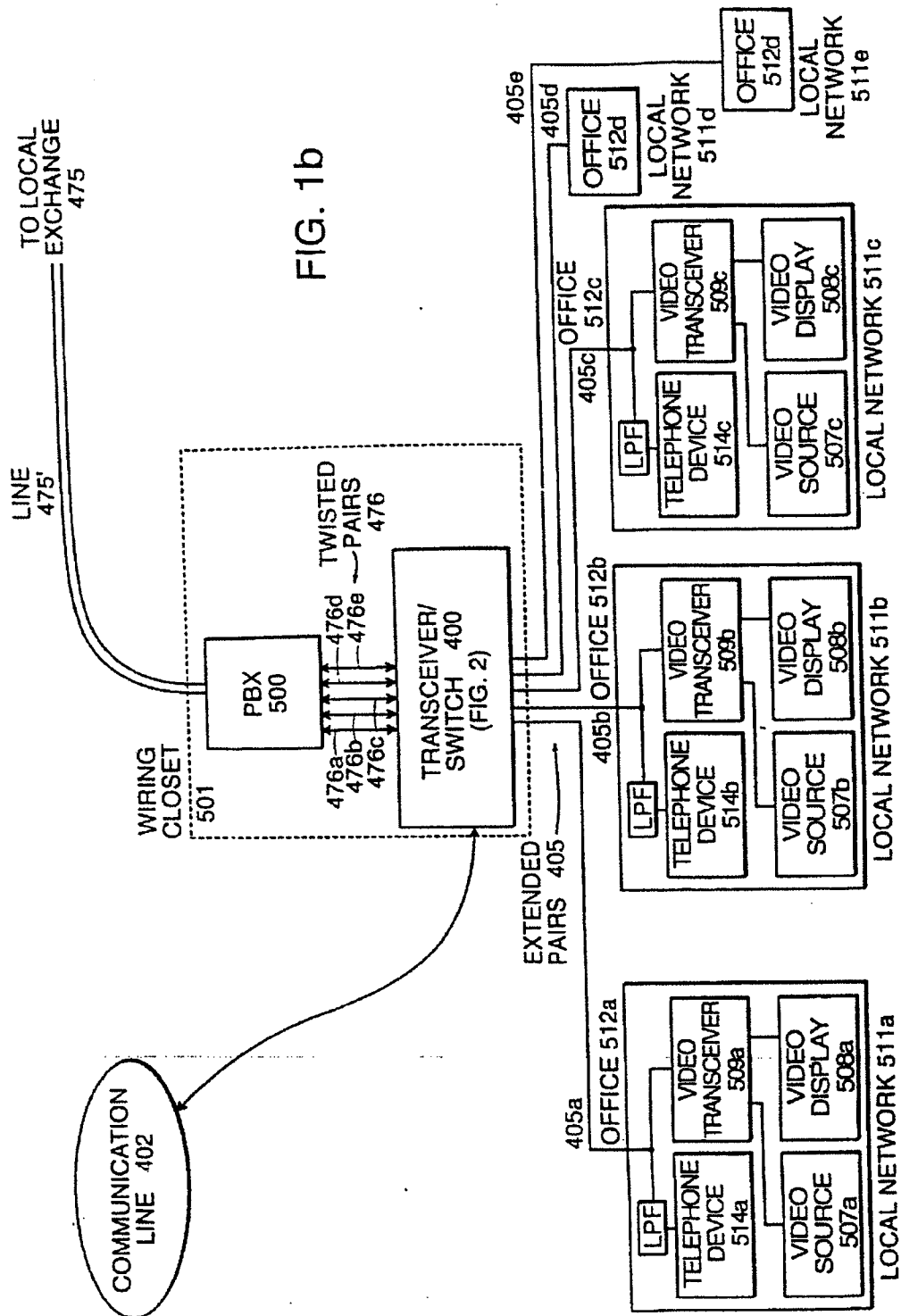


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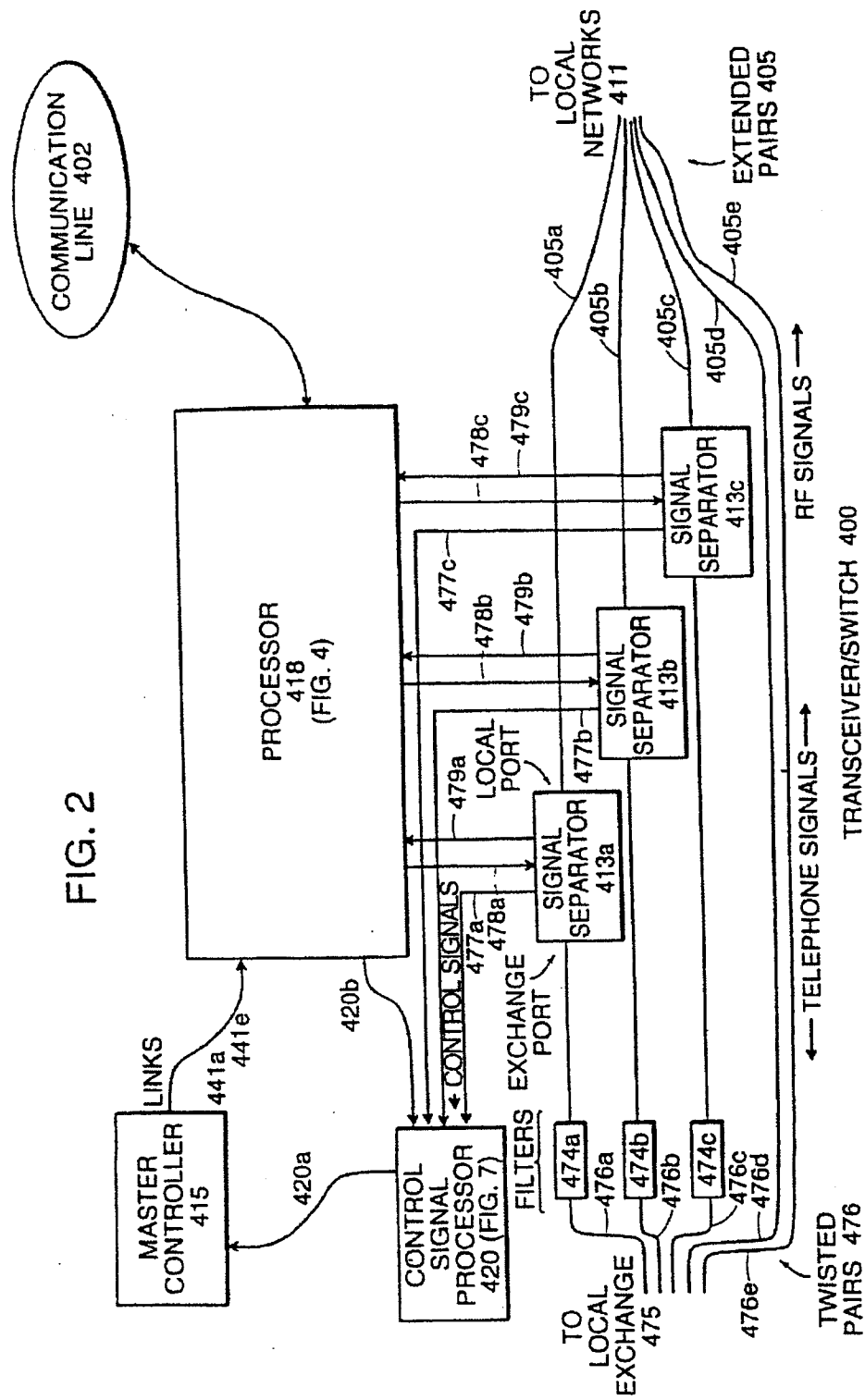
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FIG. 2

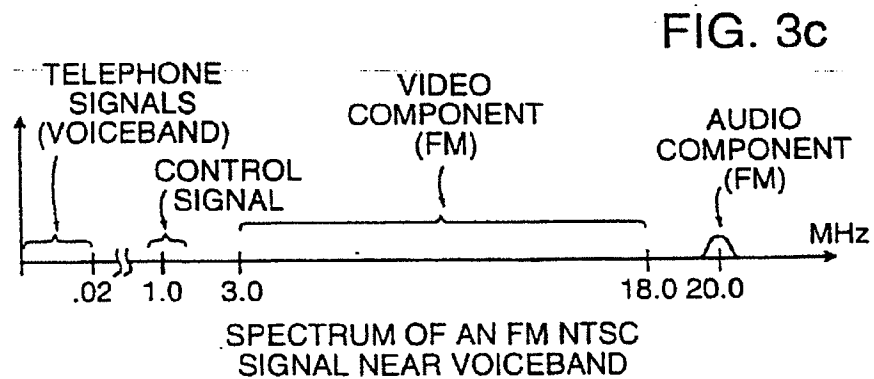
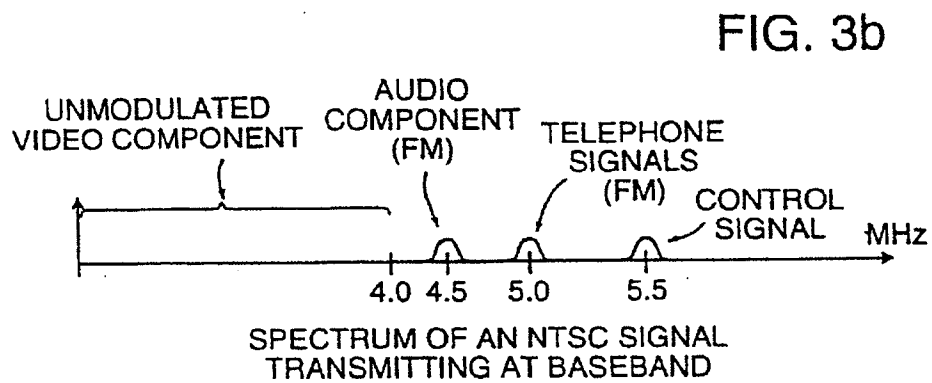
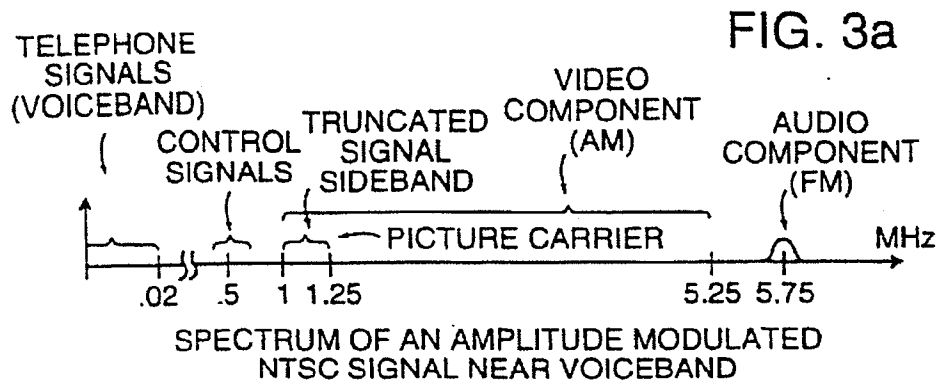


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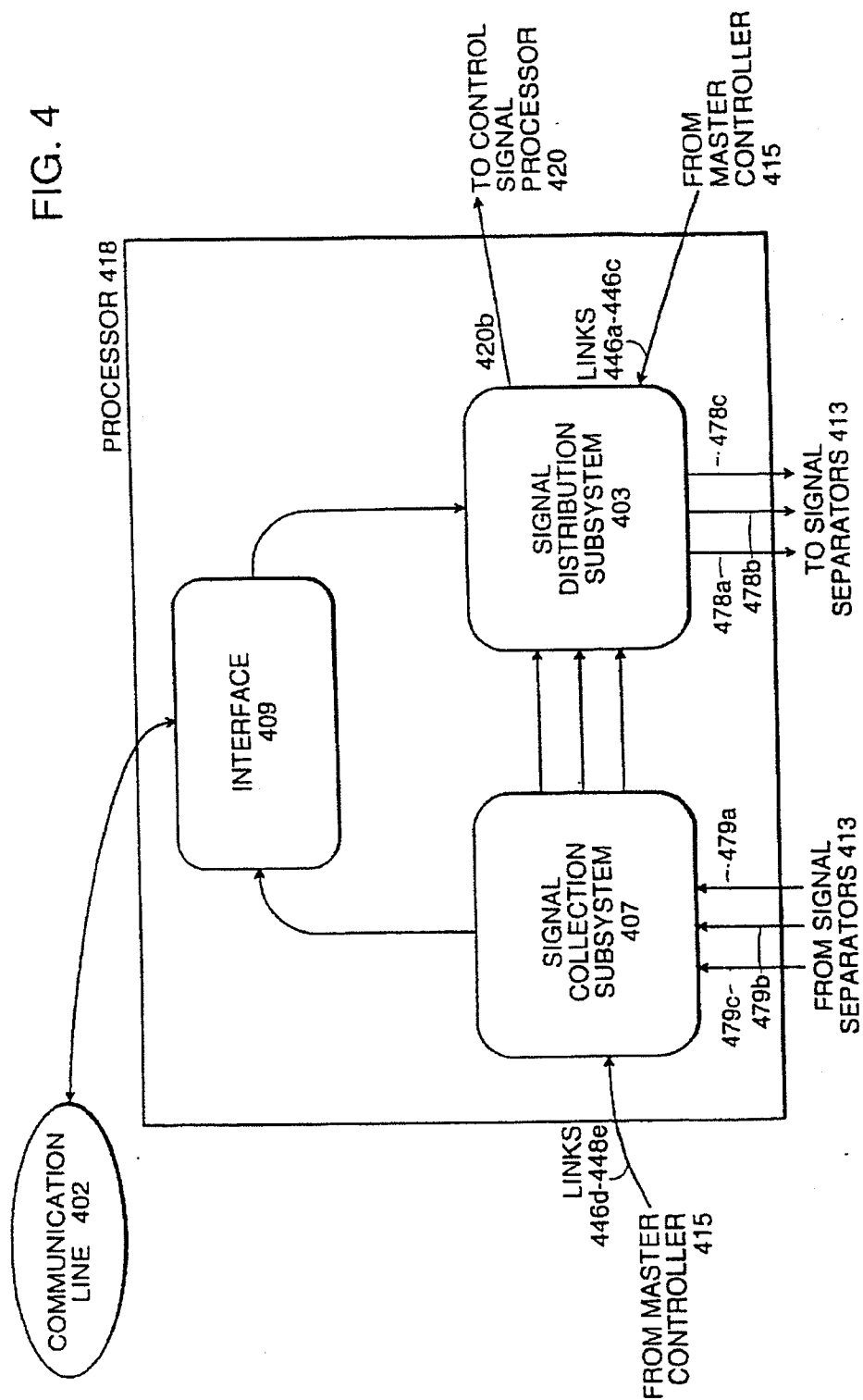
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FIG. 4



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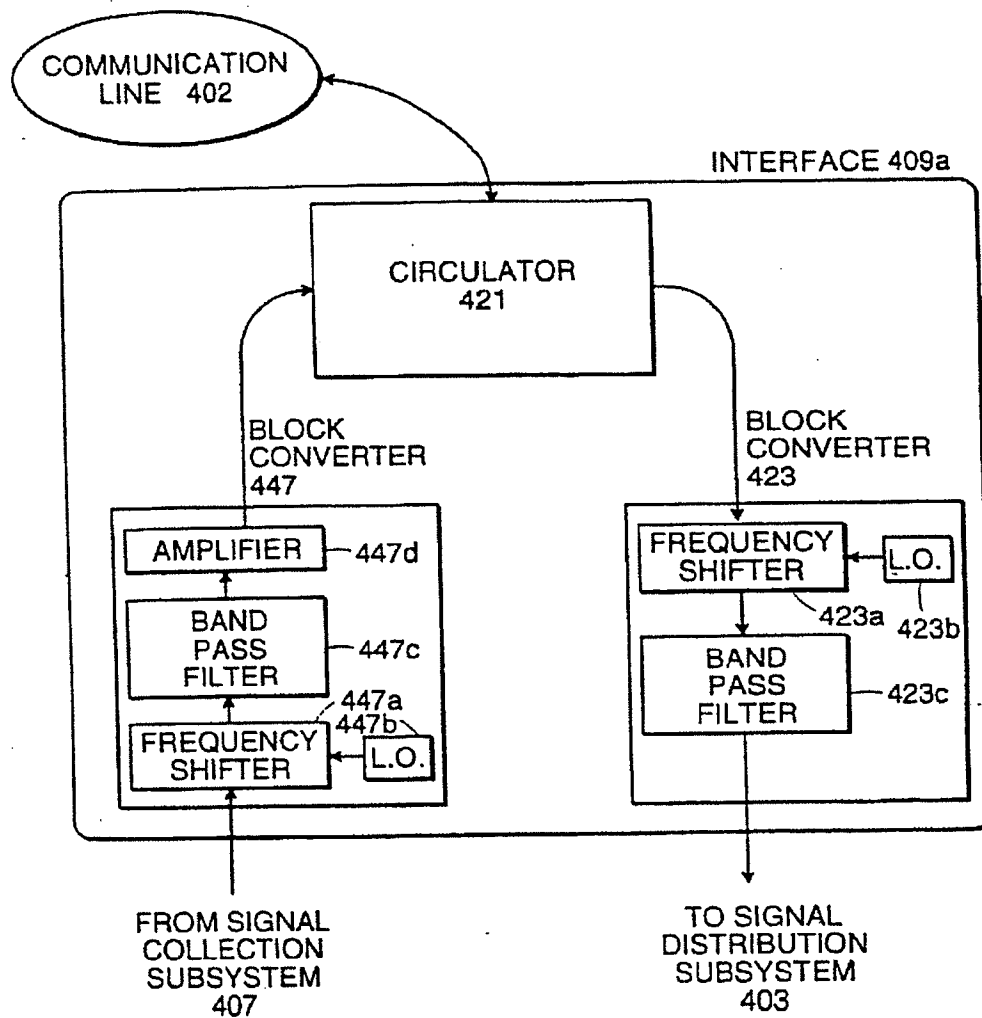


FIG. 4a

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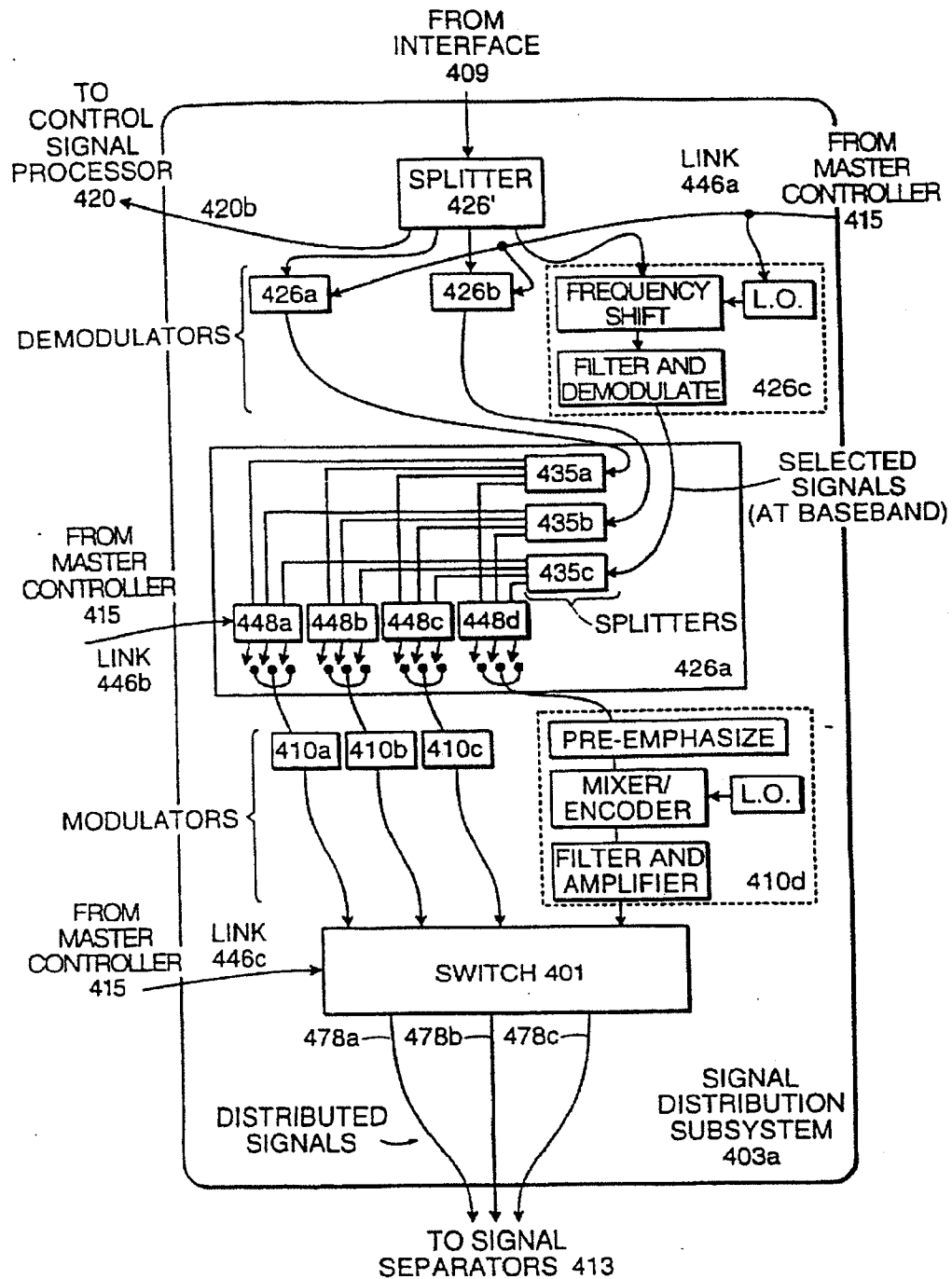


FIG. 5a

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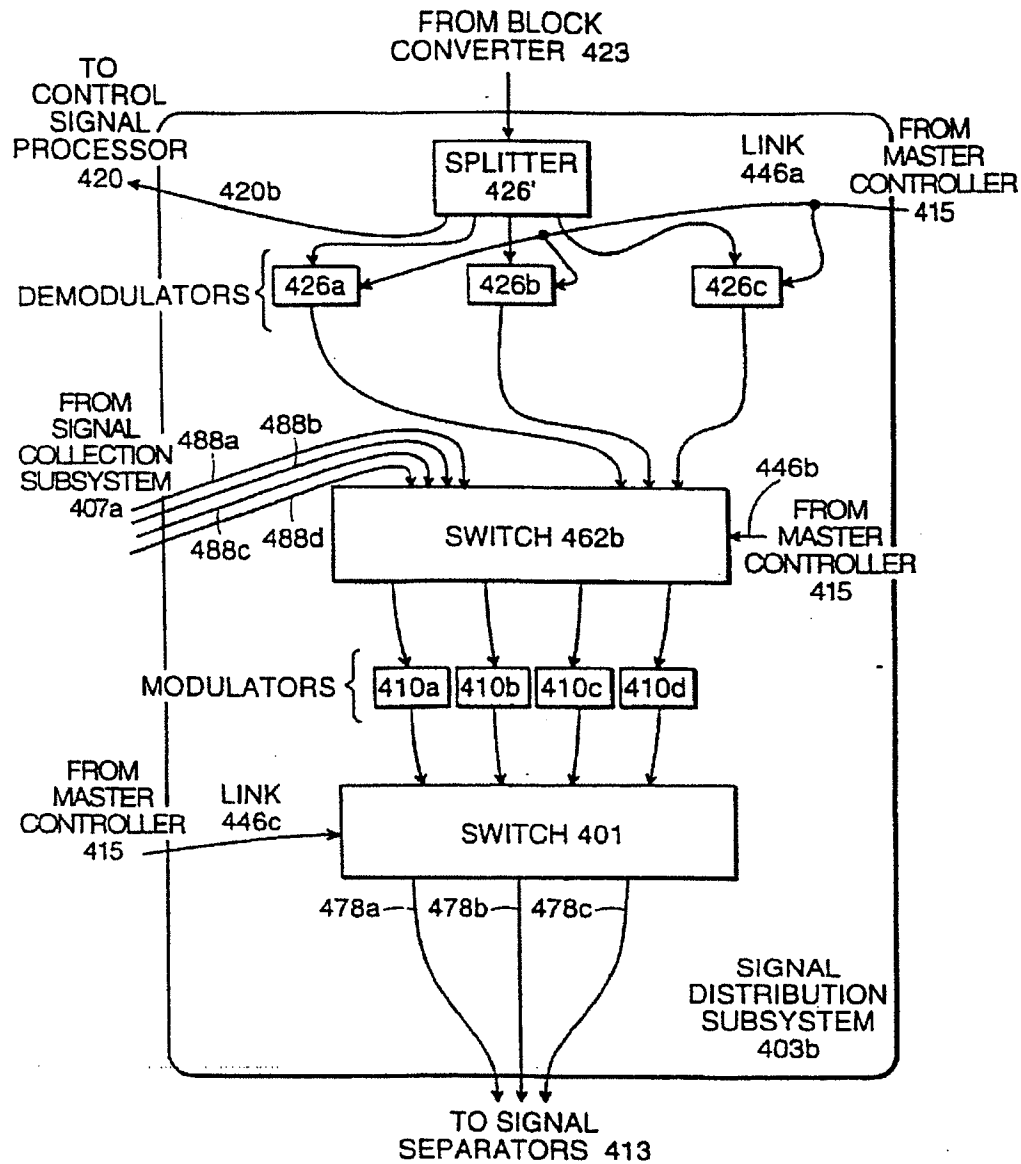


FIG. 5b

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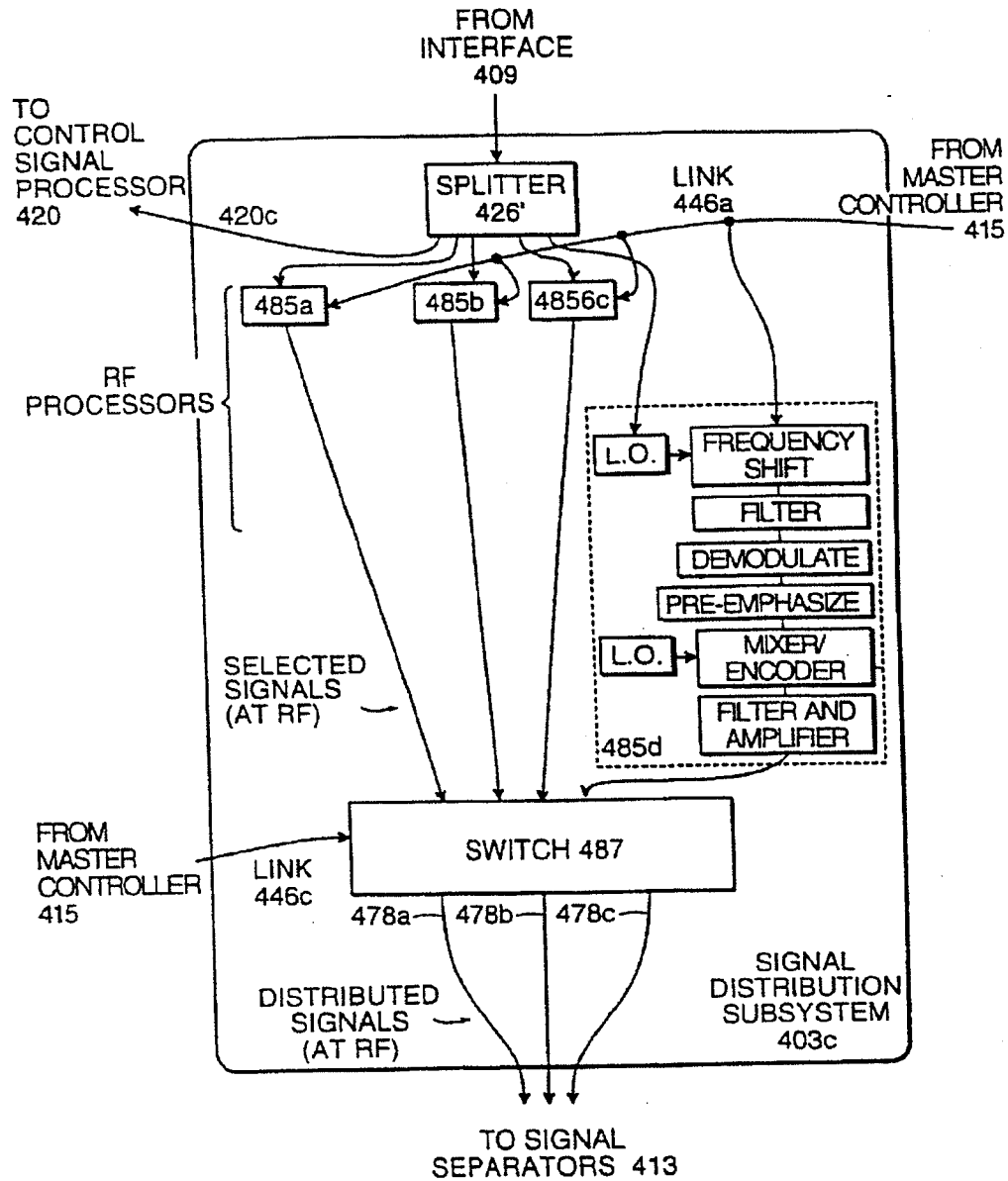


FIG. 5c

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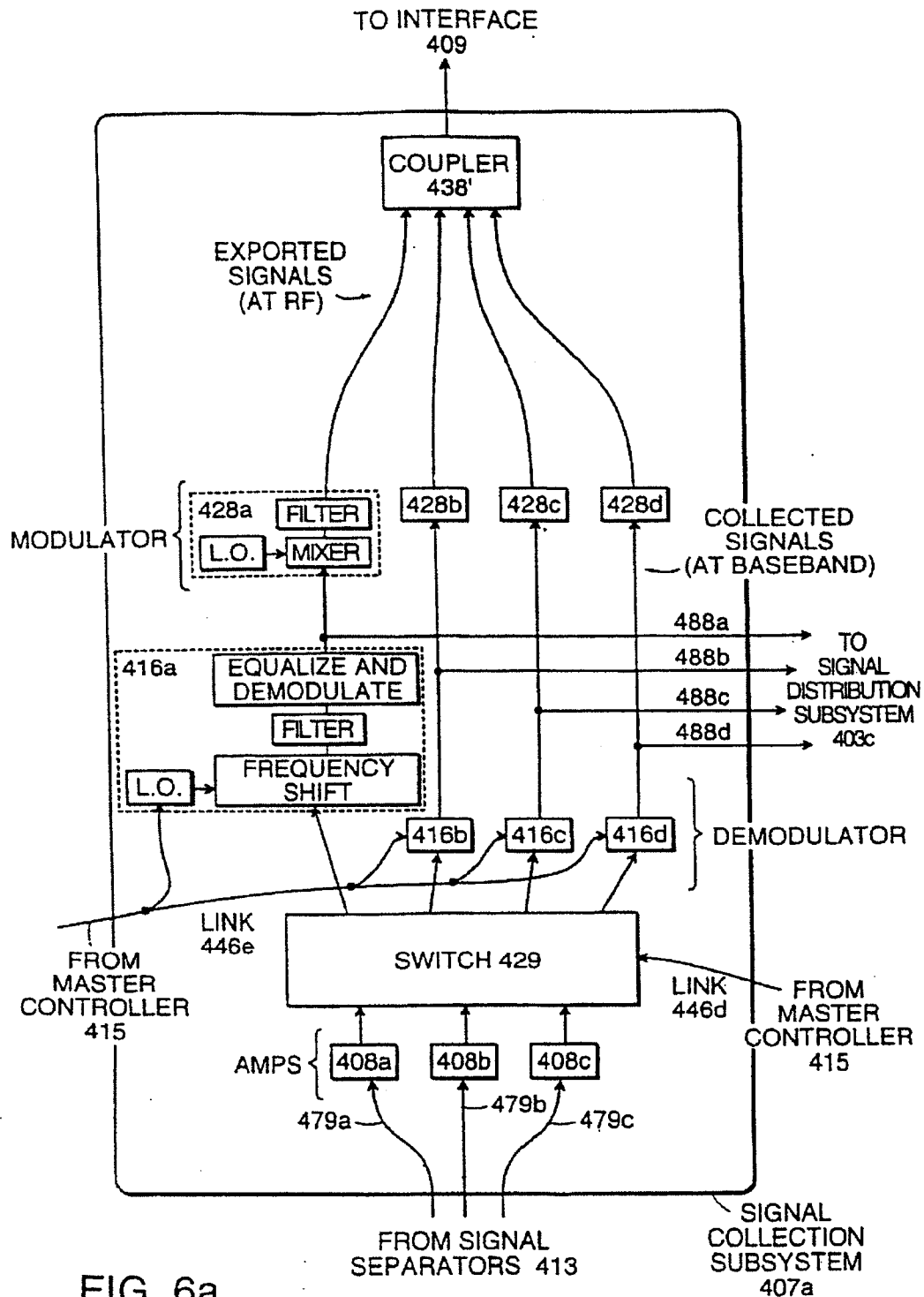


FIG. 6a

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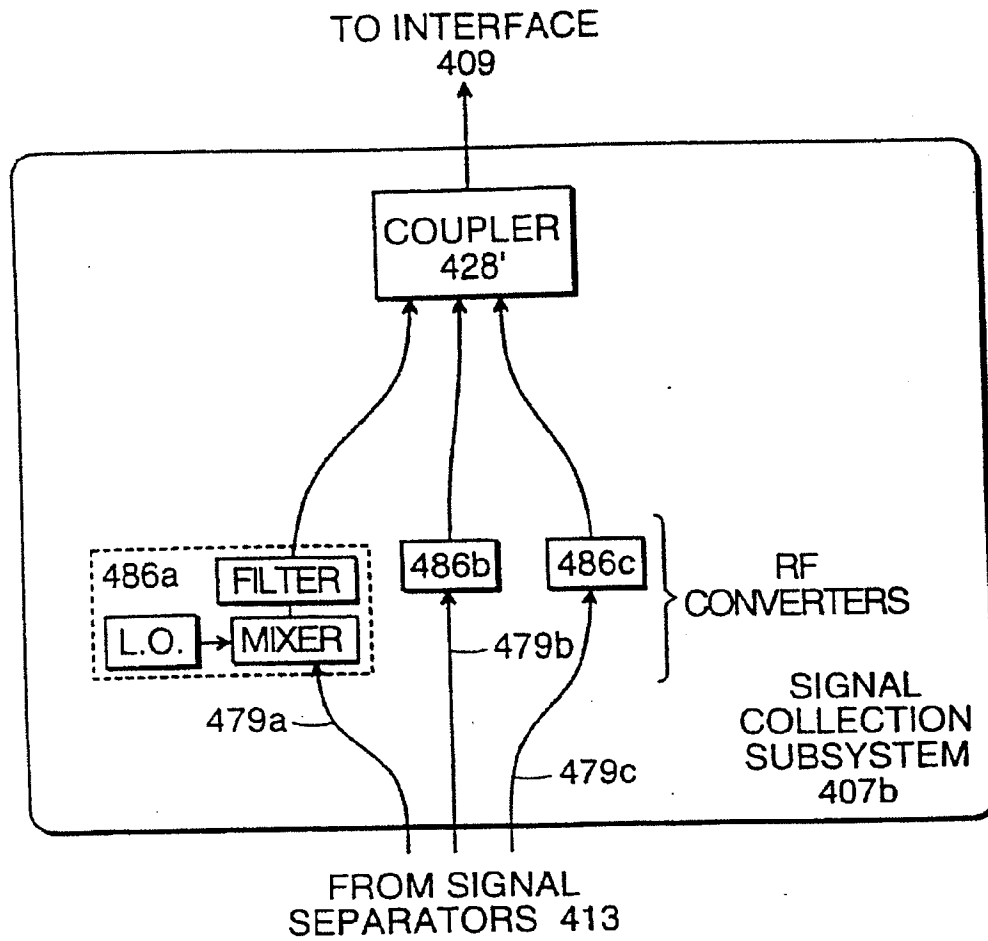


FIG. 6b

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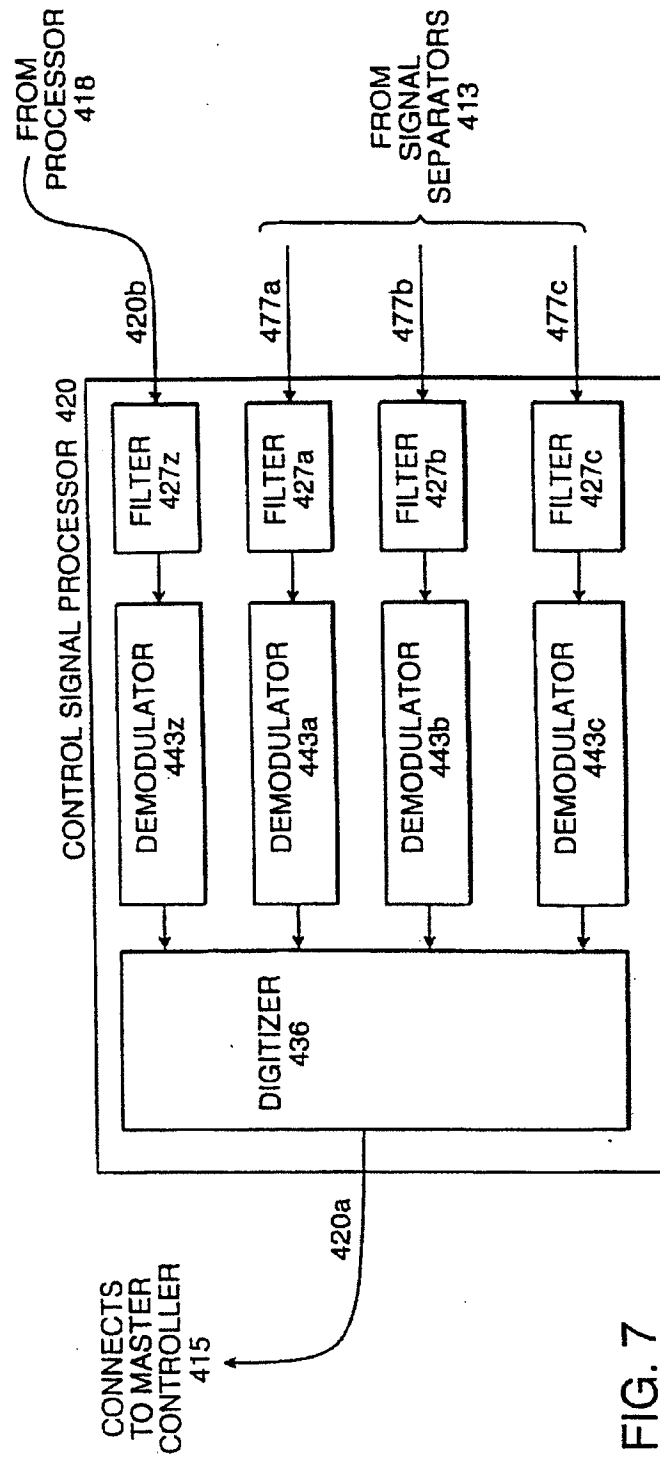


FIG. 7

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FIG. 8

	FREQUENCY DURING TRANSMISSION OVER EXTENDED PAIRS (MHz)				FREQUENCY DURING TRANSMISSION OVER LOCAL NETWORKS (MHz)		
	ORIGIN/DEST	405a	405b	405c	411a	411b	411c
CONTROL A	493a/415	22.75-23.25			22.75-23.25		
B	493b/415		22.75-23.25			22.75-23.25	
C	493c/415			22.75-23.25			22.75-23.25
VIDEO U	402/492a	1-6(AM)			12-18(AM)		
	^{492c} 402/492b	7-22(FM)	1-6(AM)	1-6(AM)	24-30(AM)	54-60(AM)	12-18(AM)
	498a		24-54(FM)			6-12(AM)	
	494b/402			24-54(FM)			6-12(AM)
X	494c/402						
DIGITAL Y	402/495c			6-18			18-40
	Z	495c/402		54-100			1-6

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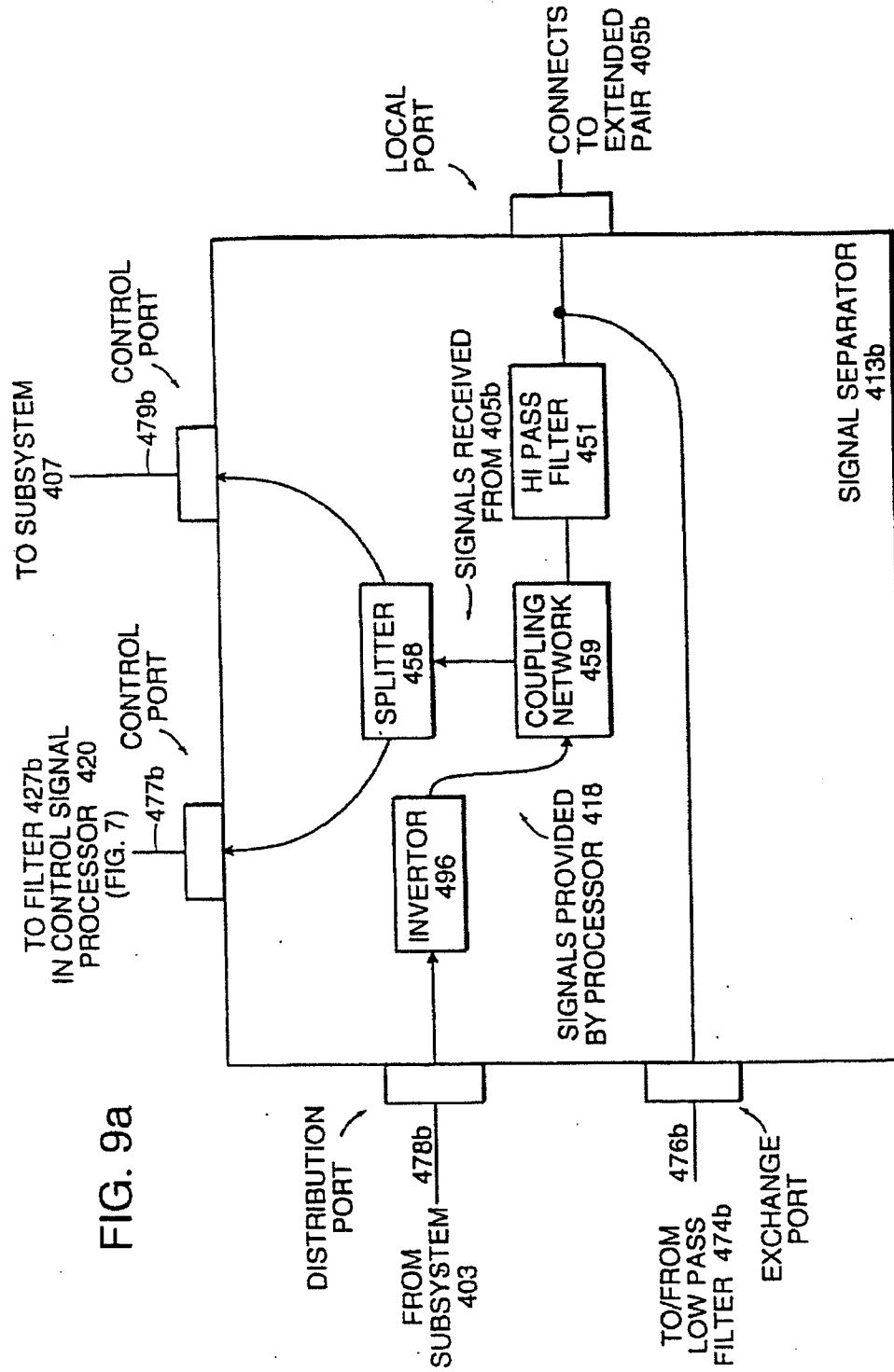


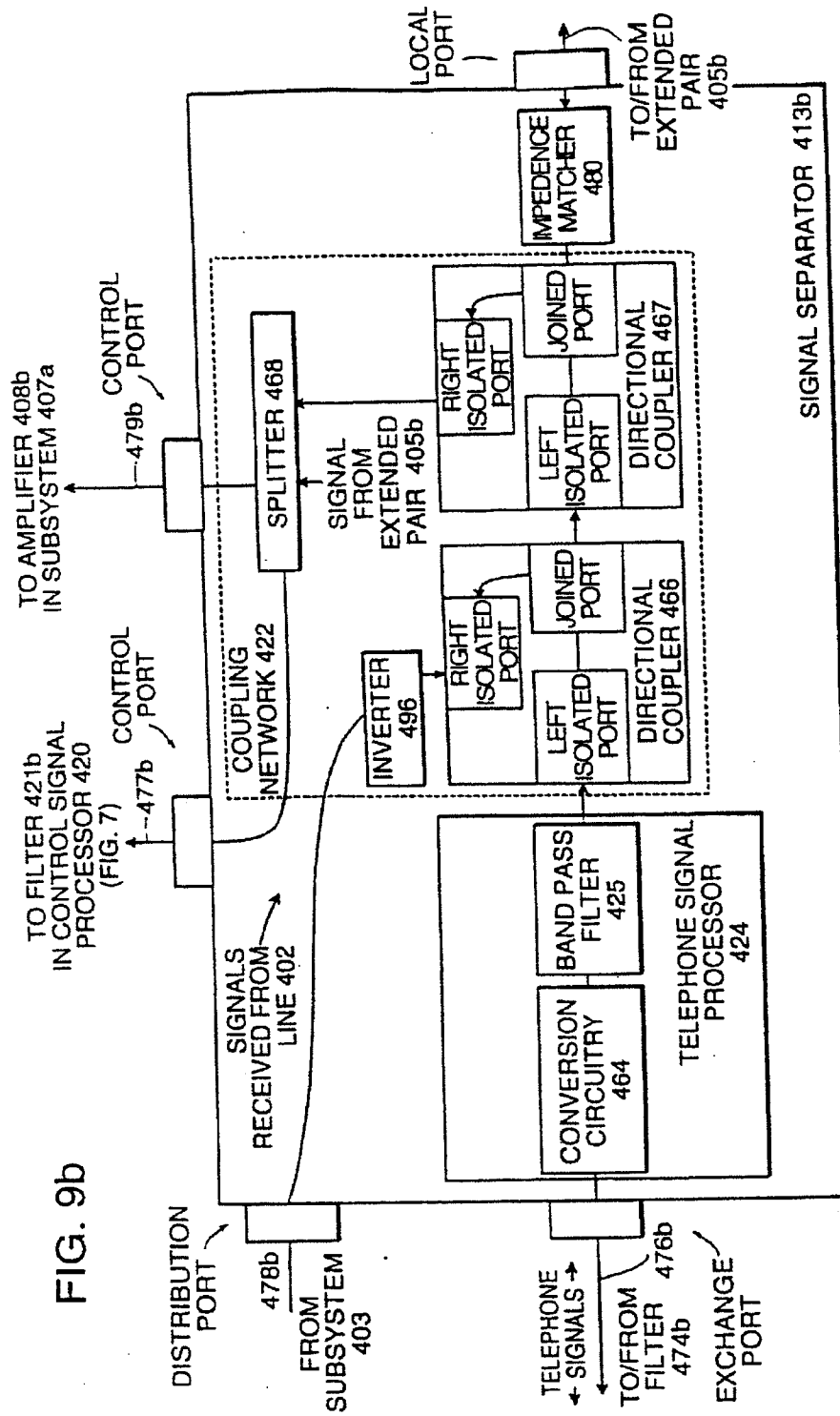
FIG. 9a

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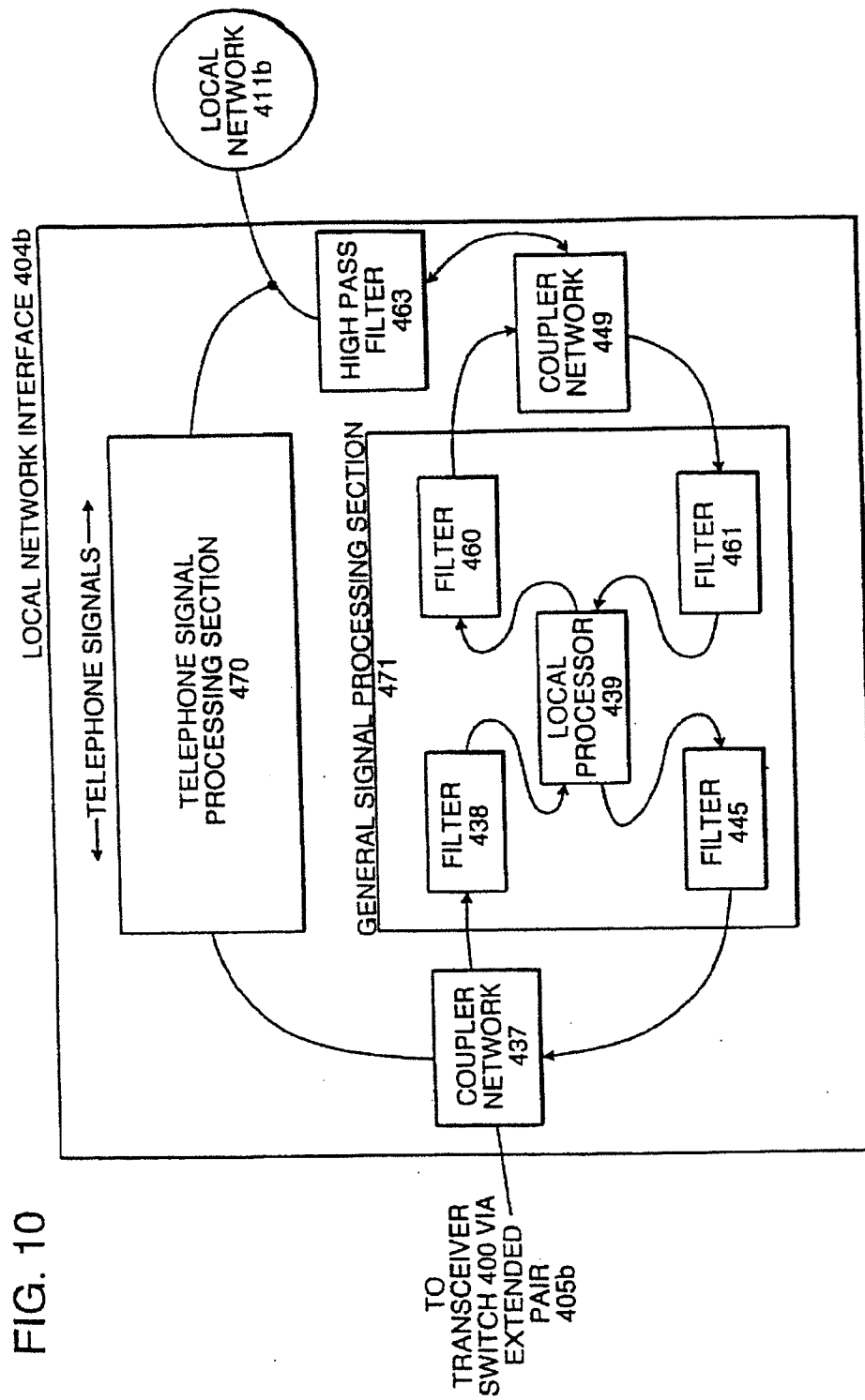


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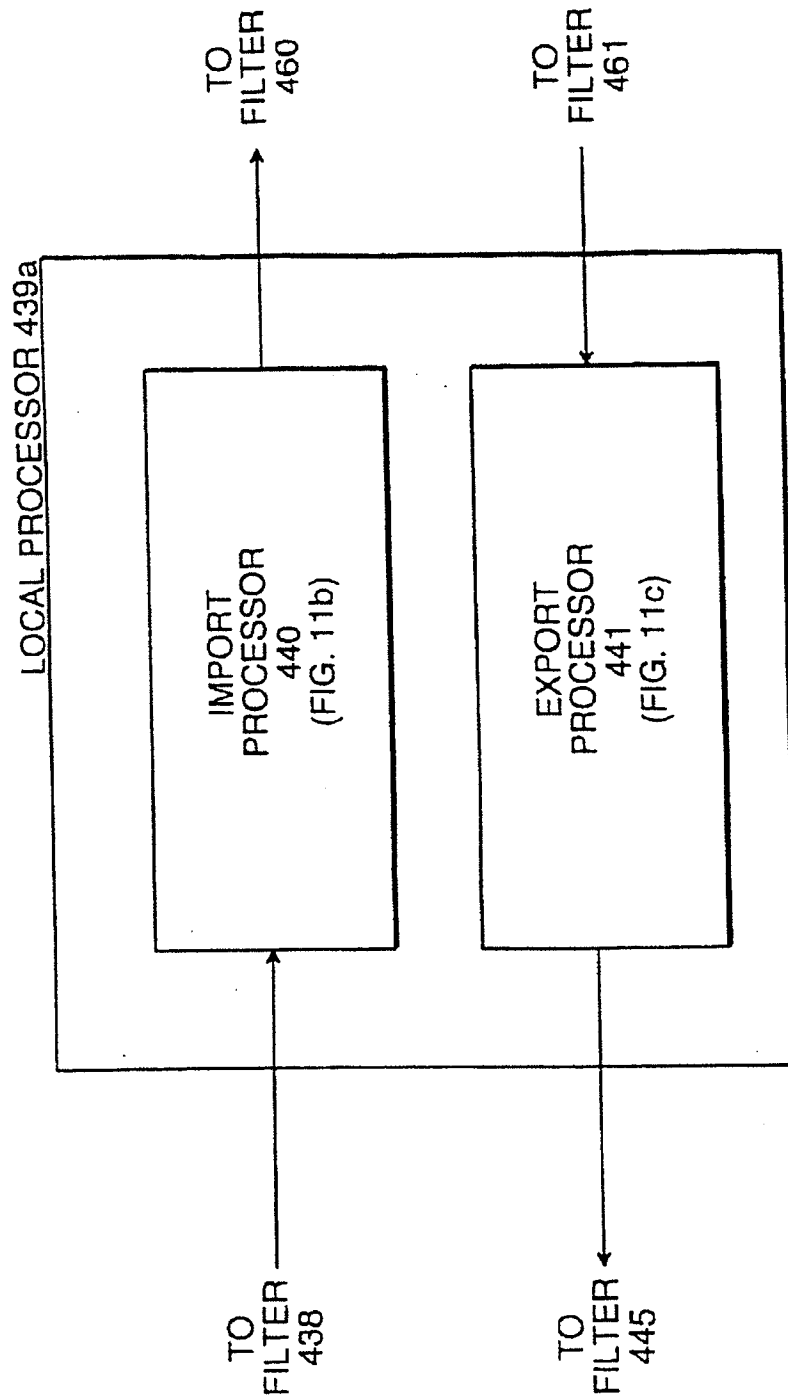


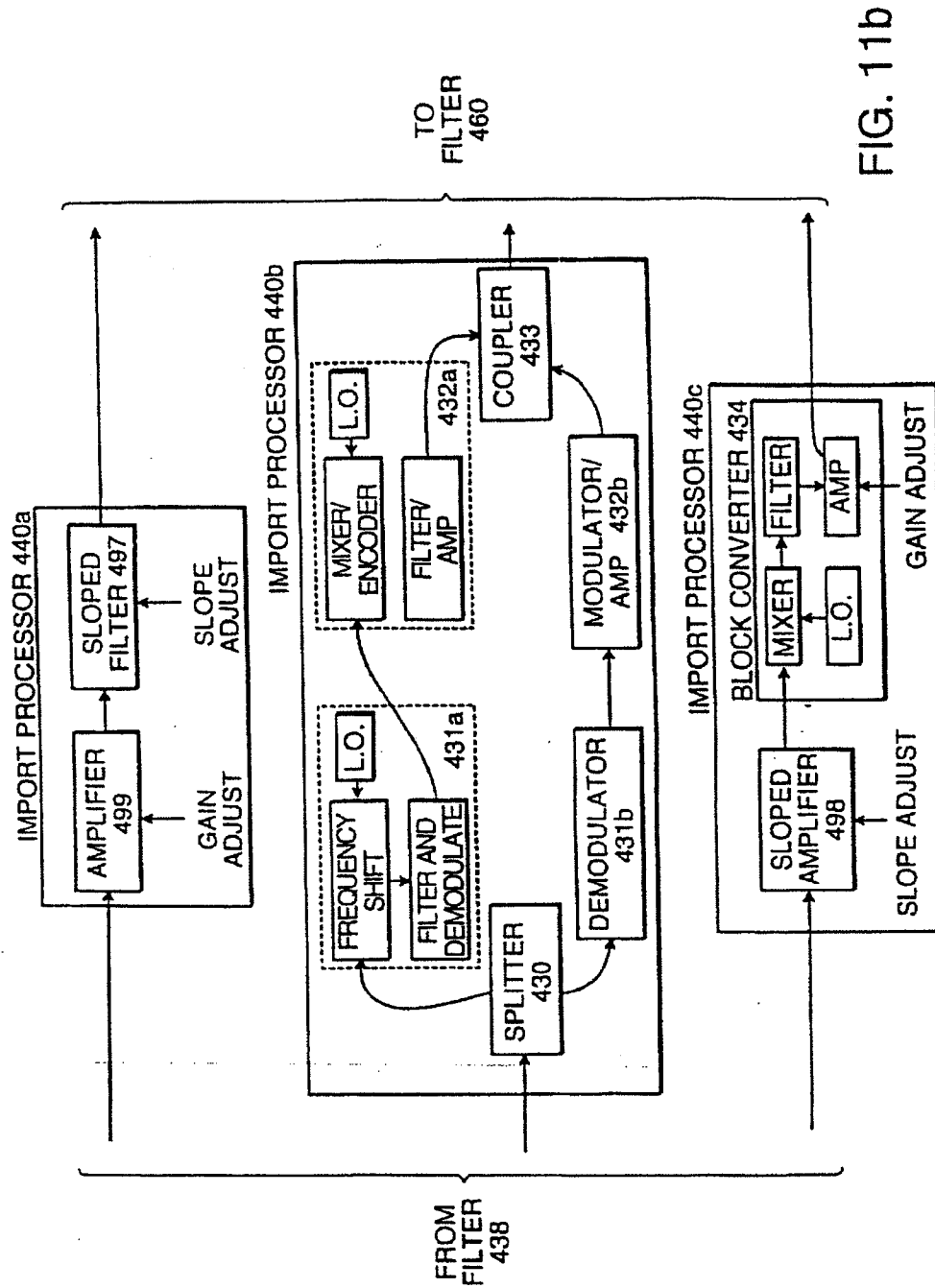
FIG. 11a

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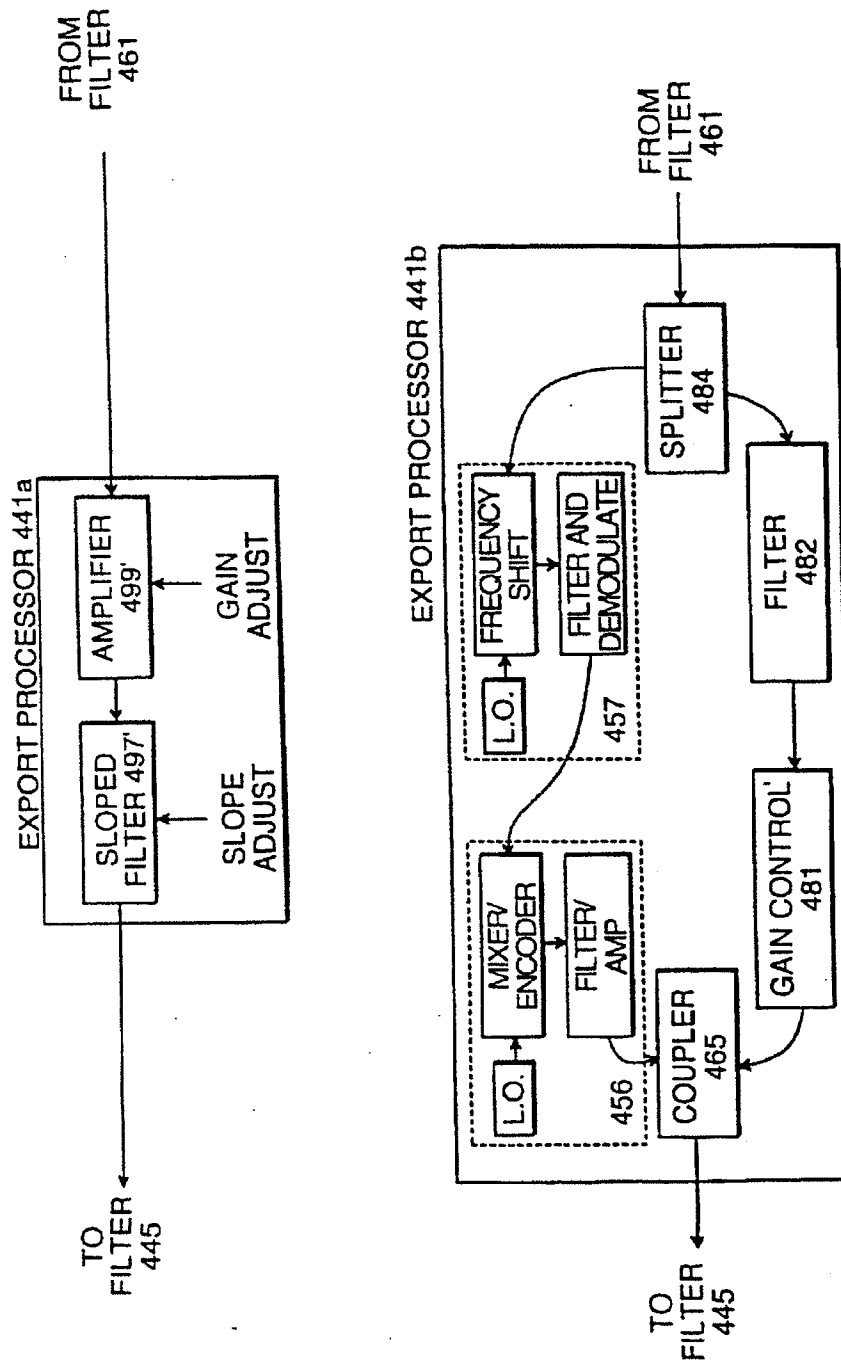
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FIG. 11c



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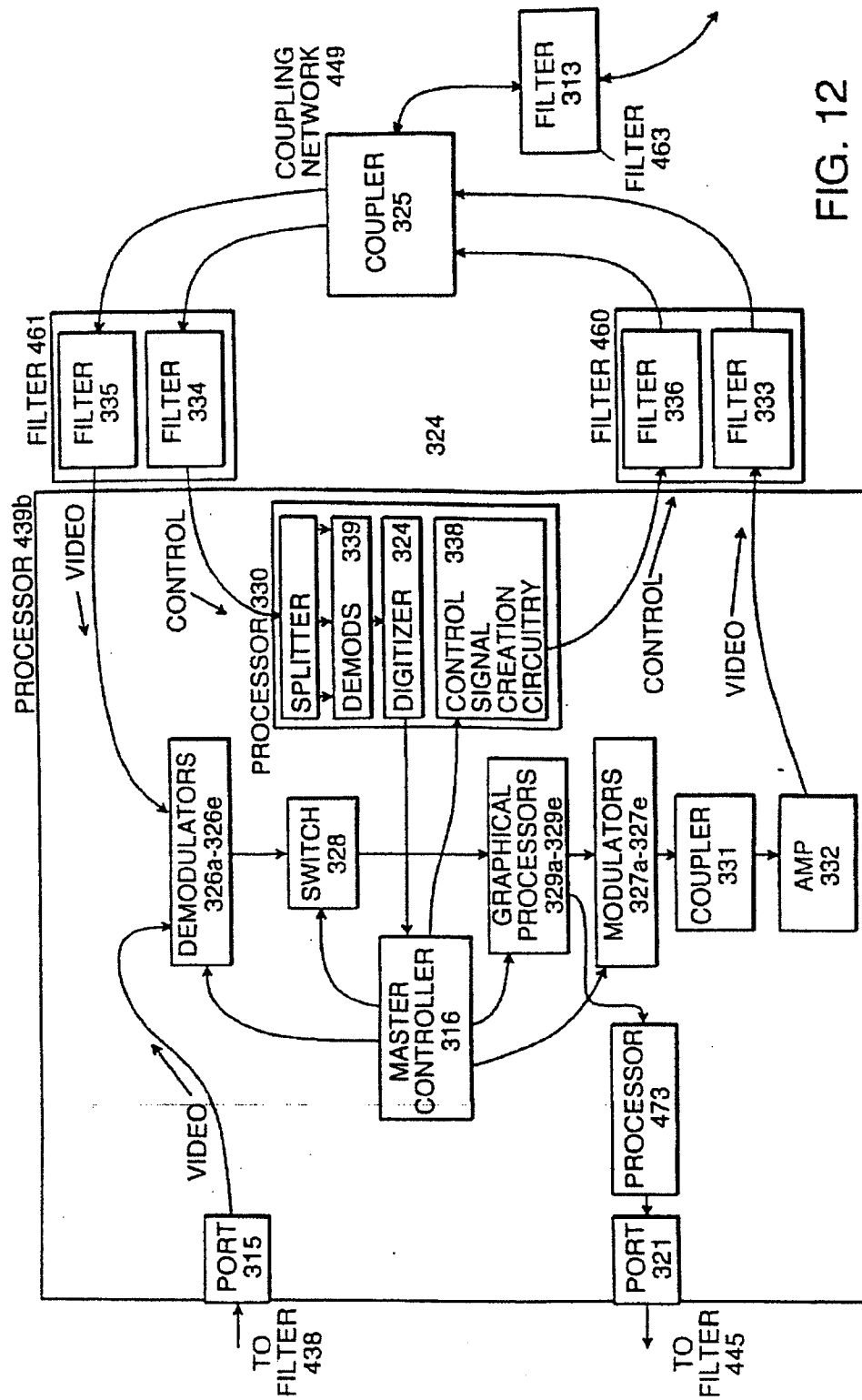


FIG. 12

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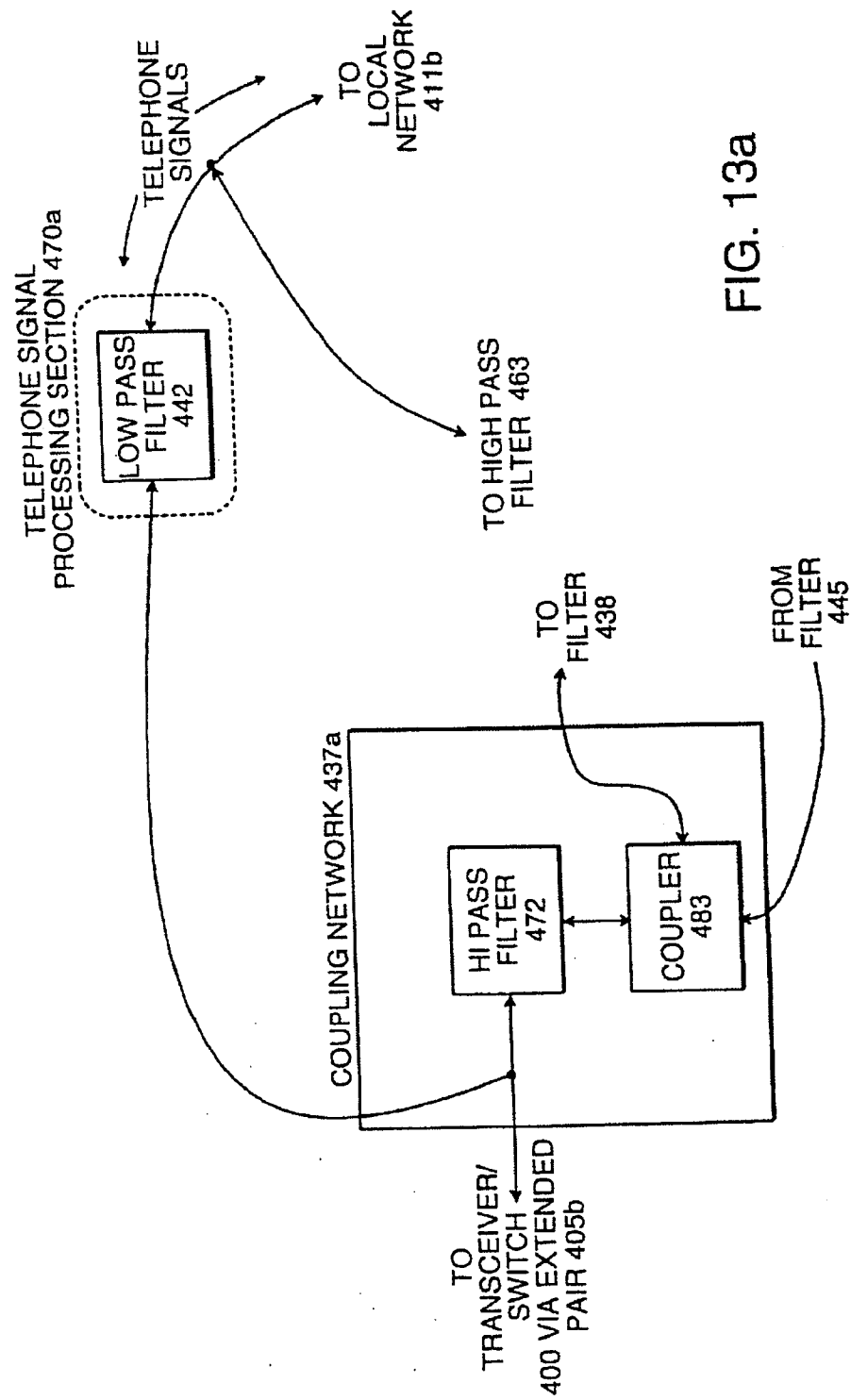


FIG. 13a

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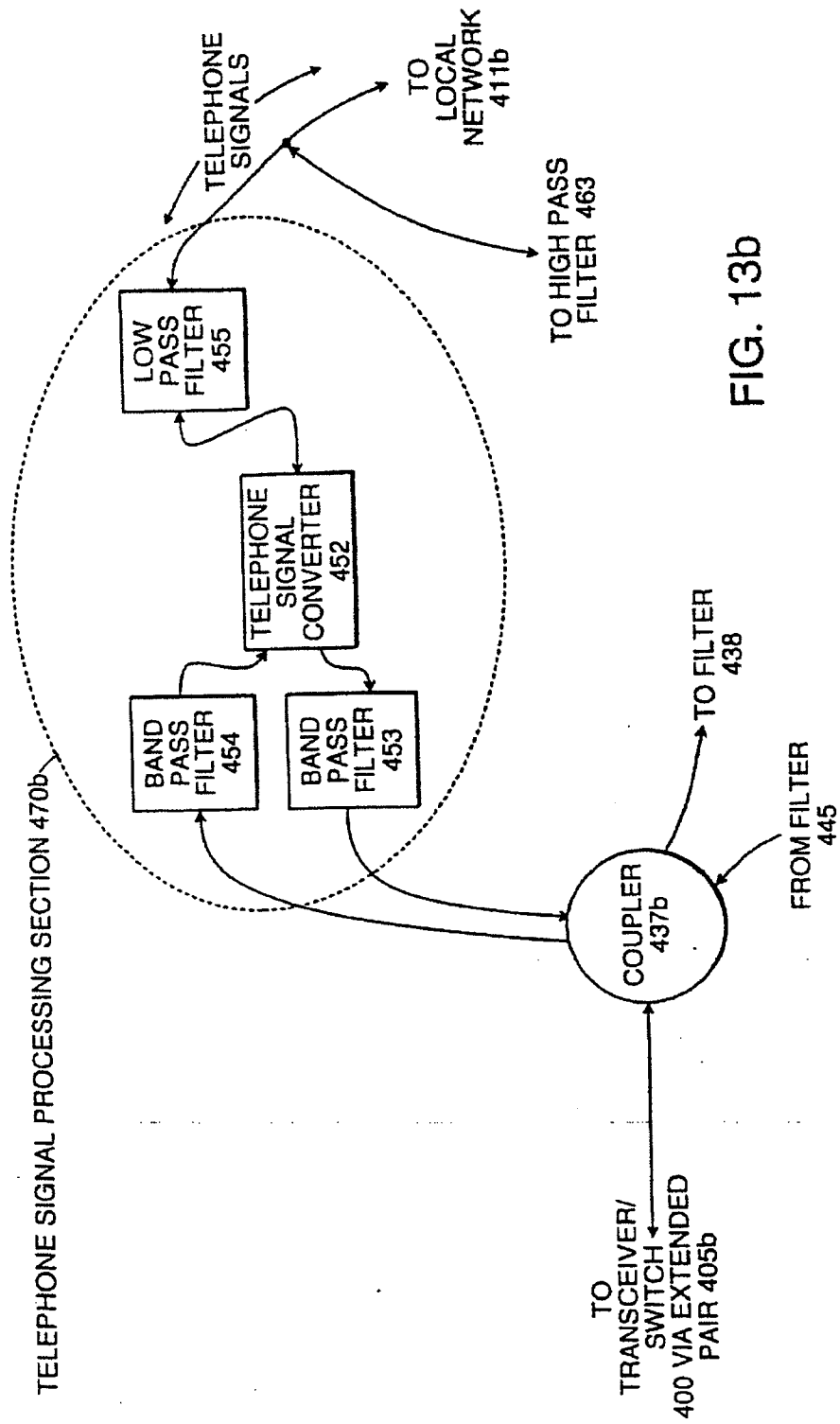


FIG. 13b

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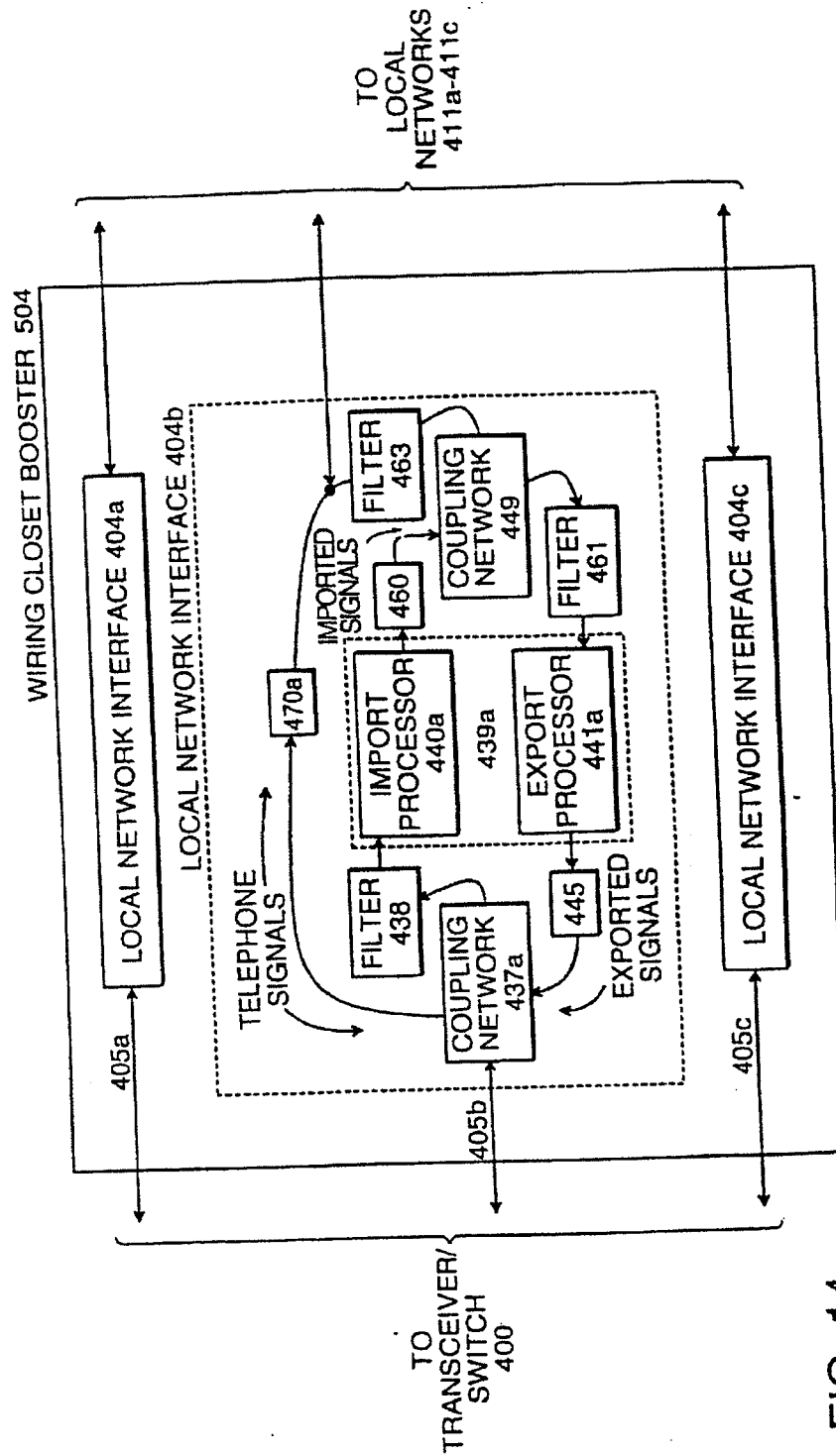


FIG. 14

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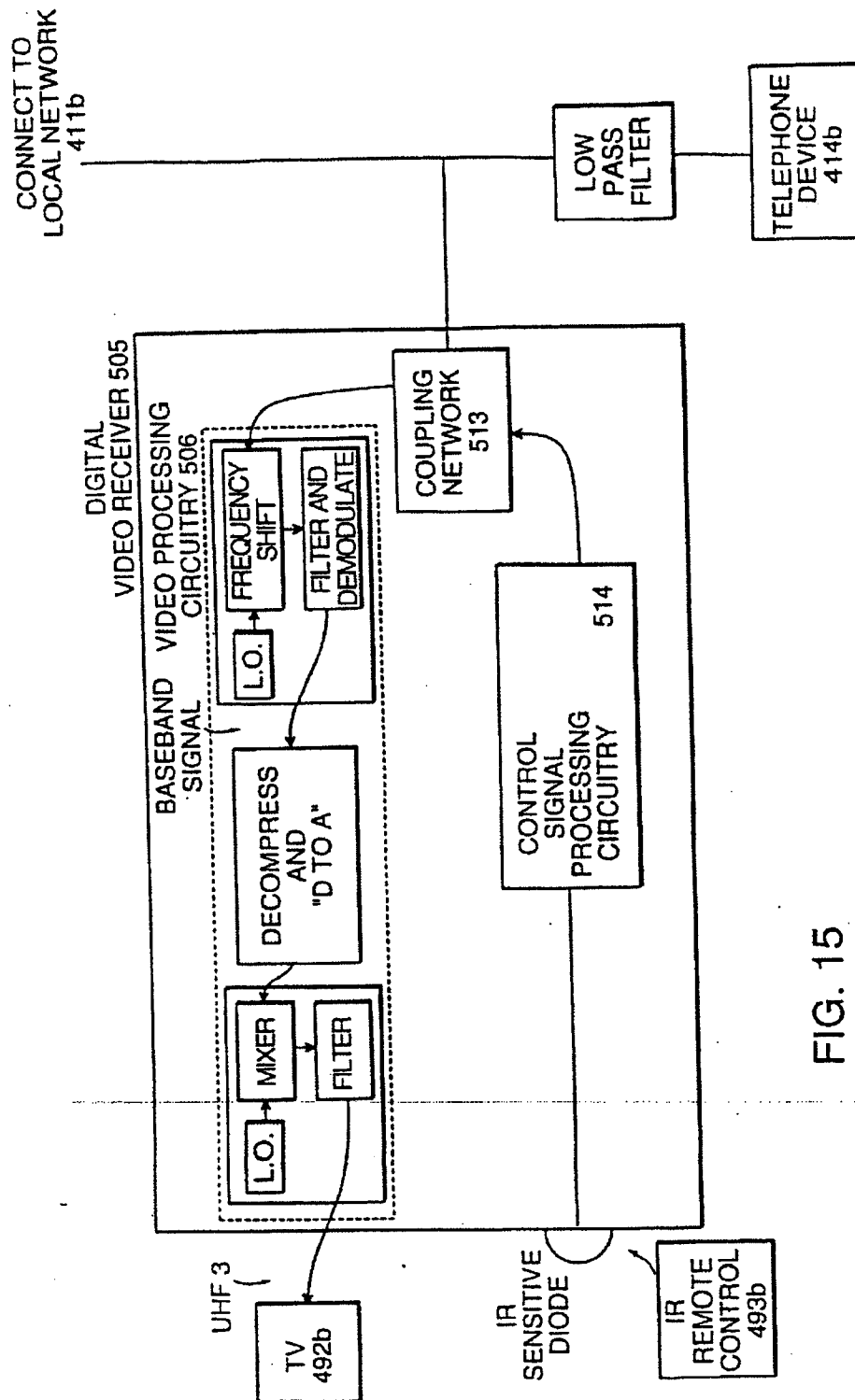


FIG. 15

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FIG. 16

